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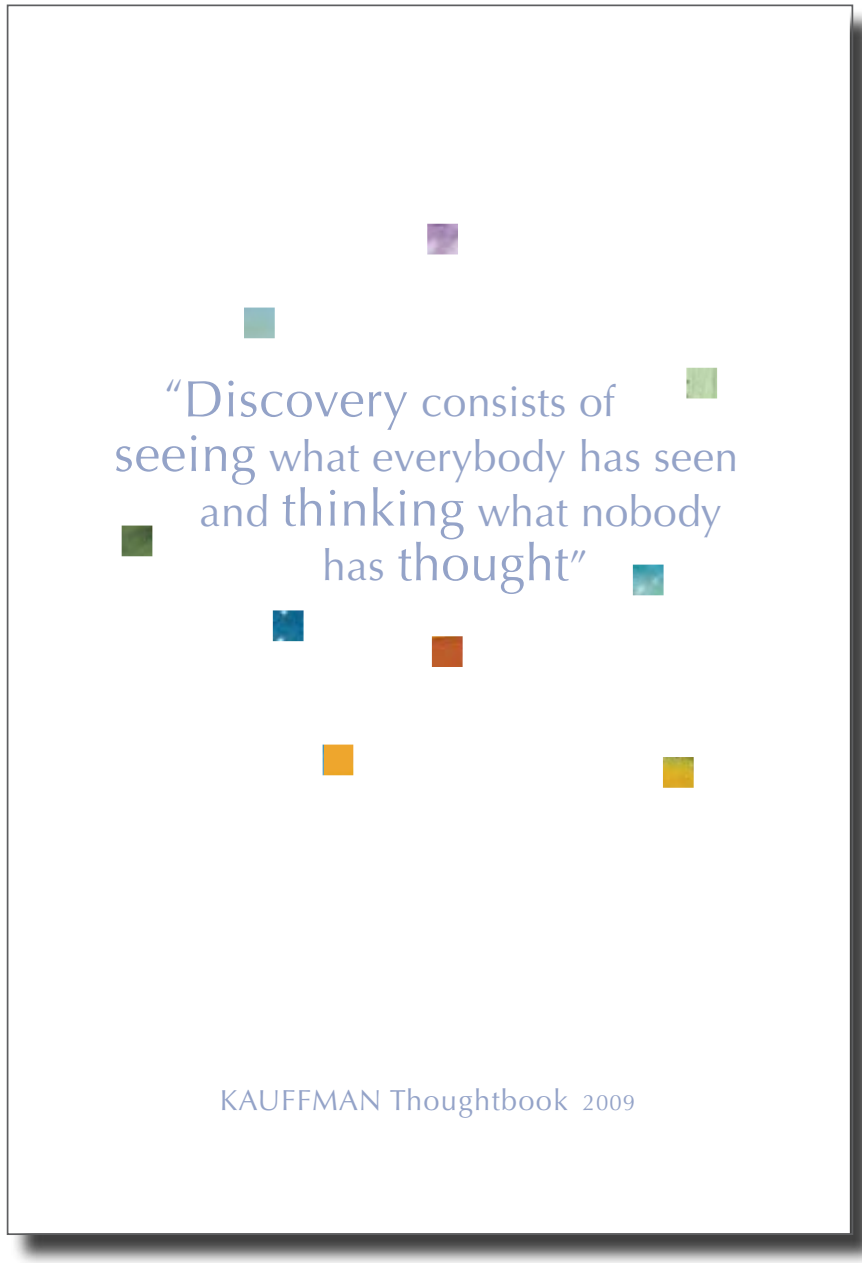

Fourth in an ongoing series, the *Kauffman Thoughtbook 2009* captures what we are thinking, learning, and discovering about education, entrepreneurship, and advancing innovation. This collection of more than forty essays is written by the talented Kauffman Foundation associates, partners, and experts who are pursuing the principles and vision set by our founder, Ewing Kauffman.

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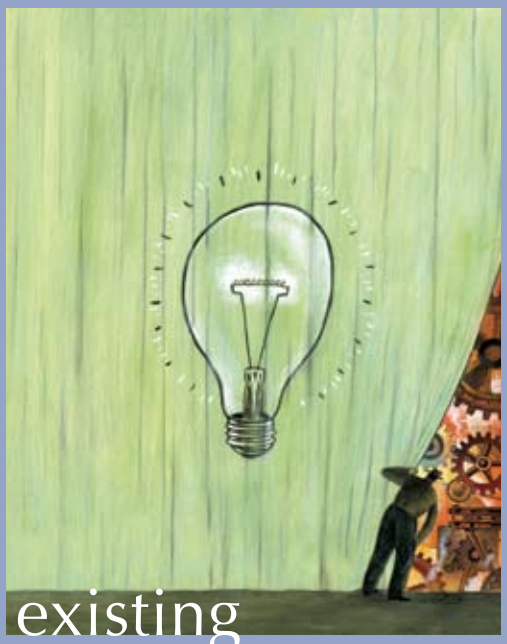


What existing models are spurring innovation and high-growth entrepreneurship?

What approaches are on the horizon?

A New Model to Catalyze a Movement of High-Growth Entrepreneurs:

Kauffman Laboratories for Innovation and Entrepreneurship

BO FISHBACK
Vice President, Entrepreneurship, Ewing Marion Kauffman Foundation

The art of formally teaching and assisting entrepreneurs has come a long way since the first courses in entrepreneurship were offered, at a handful of American universities, in the years after World War II. Today many universities have full-fledged academic programs plus co-curricular support functions. But the state of the art is still evolving, and the Kauffman Foundation is attempting to bring it to a higher level with a new initiative called Kauffman Laboratories for Innovation and Entrepreneurship.

Now in its early planning stages, the initiative is targeted to potential scale entrepreneurs: those who have innovative technologies or new business ideas that could be the seeds for high-growth, breakthrough companies. Ventures of this type are clearly valuable; they grow the economy and reshape our lives for the better. Unfortunately, they also are the hardest to start successfully, even for seasoned entrepreneurs. Learning and delivering what will give first-time founders the best chance at success is truly one of the great frontiers of the field.

Kauffman Labs is an independent, not-for-profit project aimed at creating a new kind of program for this task. There are already a number of excellent models to build on, at universities and elsewhere. Part of the initiative will thus involve

drawing upon "the best of the best" elements of these models and combining them in new ways. We also will develop and test original program ideas, drawing from the Foundation's long experience in studying, funding, and delivering entrepreneurship education programs.

Overall, the intent is to build a comprehensive set of programs offering everything that emerging scale entrepreneurs may need to form a company—from education in the basics of entrepreneurship to assistance with refining an idea, raising capital, recruiting staff and advisors, and gearing up for operations and marketing. With this vision in mind, we have developed some basic concepts to guide program design for Kauffman Labs. Many experts inside and outside the Foundation have helped us arrive at the concepts, and one person has explained the underlying rationale in a most apt way. He is Professor William Green of the University of Miami, who manages our related Kauffman Campuses initiative and who chaired our panel on entrepreneurship curriculum in higher education. (See Green's essay on page 111.)

> Using the music analogy, you could say it will be a "conservatory" of entrepreneurship, with education in the context of performance and production.

Making Music

Green notes that entrepreneurship, unlike many other fields, is not about learning or mastering "subject matter" that exists external to the field. Entrepreneurship, he has written, "generates, rather than discovers or encounters, its subject matter . . . It creates what it studies." He compares it to music, which "cannot be solely self-referential"—music must be audience-aware, just as entrepreneurs must be market-aware—but nonetheless is rooted in practice, so that education has to be "about the practitioner" and grounded in the practitioner's milieu.

Kauffman Labs will provide that kind of milieu. Nascent entrepreneurs will learn *while* doing, learn *by* doing, and learn in the company of others who *are* doing. Using the music analogy, you could say it will be a "conservatory" of entrepreneurship, with education in the context of performance and production. More specifically, we have laid down a fundamental design principle, which is to create a program geared to how the entrepreneurial process actually works, rather than trying to make it fit existing instructional systems.

And how does the entrepreneurial process work? Although there is still a lot to learn about this, we know enough to say that the ideal program for high-growth entrepreneurs should be highly *integrated, iterative,* and *networked*.

Integration in Context

Launching a high-growth venture is a complex process, with different kinds of activities to be attended to and learned. Three broad categories of activity that seem to have drifted apart in the world of entrepreneurship training, but that are inseparable in the "real world," are: innovation, commercialization, and new venture launch and growth—which are all part of the entrepreneurial ecosystem.

A researcher wishing to start a technology venture, for instance, needs to think about technical innovation—developing and tweaking the technology. "Commercializing" the technology, i.e., preparing and moving it to market, is a related but distinct task that can raise still other considerations. Then of course there are the many decisions involved in conceiving and building the company.

All of these activities are mission-critical and, more to the point, they are interrelated. Choices in any area affect choices in the others. Technical and business thinking have to intertwine constantly in making tradeoffs and

re-starts. Thus Kauffman Labs will teach the discipline as an integrated whole, with entrepreneurs learning from experts in multiple areas as well as from one another.

Iteration and Networking

Developing a high-growth venture also is an iterative process. In most cases the original concept is barely a first draft of what the venture ought to look like. The entrepreneur must go through repeated rounds of testing (both conceptually and market-based) and re-invention, in response to changing market signals and other factors. Leading people along this iterative path and teaching the skills to navigate it is, in some ways, akin to the American Idol competition, where entrants go through iterative rounds of preparation, market testing, and coaching for the next round. The program has produced star after star from its list of finalists, and we think that a highly iterative program can raise the yield in high-growth venturing, too.

Kauffman Labs can also be of great value to the entrepreneurs who don't "make it to the finals"—that is, whose ventures fail.

Kauffman Labs can also be of great value to the entrepreneurs who don't "make it to the finals"—that is, whose ventures fail. Through the iterative approach, we can help them look at all the reasonable options and fail fast. Failing fast has many virtues—you save time; you learn lessons for the next venture—and just providing a good venue for fast failure would be an essential service.

Finally, networking is crucial to every aspect of entrepreneurship. We know that the most successful entrepreneurs have frequent, extensive contacts with people in the various fields and industries that could conceivably relate to their work. These contacts help them to think entrepreneurially. They provide insights

that can help them spot, and act upon, unclaimed opportunities. And of course the contacts are useful in recruiting talent, investors, partners, advisors, and customers for the venture.

Kauffman Labs could provide valuable access to human capital by having industry experts on site, while also leveraging the Foundation's far-reaching connections. There are many possibilities to be explored—which, indeed, is true of the entire Kauffman Labs project.

The Larger Goal

In creating new programs, Kauffman Labs will draw from innovative models described elsewhere in this Thoughtbook: university proof of concept centers (page 60) and private-sector accelerators (page 67). We also have looked at innovative MBA programs, and at a wide range of both campus-based and regional public/private programs that excel, in particular ways, at supporting entrepreneurs.

Importantly, Kauffman Labs will encompass a number of programs the Foundation already operates, including our long-running FastTrac® program, our Global Scholars Program (see page 164), the iBridge℠ Network, (page 73), and our Web sites at *entrepreneurship.gov* and *entrepreneurship.org* (page 182).

This project is being called Kauffman Laboratories because it will serve as a testbed for ongoing experimentation. Success will be measured not only by how many ventures the project can help to launch and grow, but by how well it advances the "science of startups." The goal, then, is to discover principles and practices that everyone can use for bringing high-impact technical and business innovations to market more effectively. Ultimately, we hope Kauffman Labs will spur a movement of many more high-growth entrepreneurs who will grow our economy and expand human welfare.

Beyond Licensing and Incubators:

Next-Generation Approaches to Entrepreneurial Growth at Universities

LESA MITCHELL

Vice President, Advancing Innovation, Ewing Marion Kauffman Foundation

It has long been known that universities play a role in economic development, dating back to the 1800s when Land Grant universities were created to provide skilled people and new research knowledge for a growing economy. The way we perceive and manage that role has changed, however. Universities now are expected to generate growth, rather than merely sustain it, especially through entrepreneurial companies bringing research to market.

Public policymakers and university officials worldwide are striving to accelerate this process of innovation and commercialization. And, in many cases, the approach they use centers on a twin set of institutions: having a strong technology licensing office at the university to patent and license research technology, while building incubator facilities or technology parks nearby to help "breed" startup companies.

One can see why this is deemed a winning formula. The Bayh-Dole Act of 1980, which enabled technology licensing on a wider scale than before, is oft given much of the credit for recent university-driven innovation in the United States, while Stanford University's renowned technology park was an early hub of the growth in Silicon Valley. Therefore, one may conclude, the route to successful new companies in a given region must be to license and incubate startups.

At the Kauffman Foundation, we have a broader view. After years of studying how innovation works (or fails to work) in and around universities, we are finding emerging new solutions.

Many Pathways to Innovation

Our studies began with looking at how to improve licensing outcomes. At many universities, a given office becomes the *de facto* control center for the innovation strategy. Faculty, who make inventions or discoveries, work through the licensing office, which is charged with a multitude of tasks—from determining commercial viability to patenting, licensing, and earning revenue. Many, but not all, of these offices are under-resourced for such a large agenda, and are in a constant push-pull based upon competing university priorities. In working with universities to address these topics, we learned of an underlying issue that may pose a greater concern: a tendency to focus on patenting and licensing to the neglect of other modes of innovation due to the competing concerns.

University outputs and pathways can provide a new source of entrepreneurial outcomes in addition to patenting and licensing.

High-profile success stories have led us all to think of patentable technologies as the universities' primary form of innovative "output" to the economy, and of licensing as the main means of commercial diffusion. In fact, as innovation scholars have pointed out, universities have a range of valuable outputs—from "information," or knowledge, to human capital—and there are many possible pathways for diffusing them into the market: through consulting engagements, through non-patent-based startups, or simply through networking entrepreneurial students and faculty.

We see evidence that these outputs and pathways, if well-cultivated, can provide a significant new source of entrepreneurial outcomes in addition to patenting and licensing. For instance, many MIT students and alumni are prolific entrepreneurs and, in a program that serves them, called MIT Venture Mentoring, the majority of the mentored companies do not hold intellectual property from MIT. Most either are based on new business models to meet a need in a market, or they are software companies, which tend to rely less on patents. A replica of this model has been implemented in St. Louis at Washington University with some early visible success.

Also, business plan competitions now are common on U.S. campuses, and their potential has yet to be fully explored. A recent Angel Capital Association panel noted that these competitions, in which few of the plans depend on licensed technology, might be more likely sources of new-company formation than are licensing university patents. Conclusion: Patenting and licensing are certainly important, but a brighter future awaits universities and regions that, supported by resources across the campus and from a local entrepreneurial community, can tap the whole spectrum of innovation.

Better Early-Stage Help

As for incubators: There are times it makes sense to bring fledgling firms together to share lab facilities and services, and there can be synergies from the interaction. But, in too many cases, the incubator also is a real estate project that has to make real estate sense. If wet labs are needed, they can drive the costs quite high, and if filling the space becomes a concern that trumps serving the entrepreneurs, much of the value is lost. There are examples of successful incubators in places like St. Louis and Madison, Wisconsin; however, there are many more examples of failures. We should continue to learn from the successful incubators, while also considering new models.

One such new model, the proof of concept center, is seeing success, both as an incubator of early-stage ideas and as a way to provide students and faculty an opportunity to experience commercialization in a real sense (see the sidebar below). Proof of concept centers do not require shared physical space, but instead provide funds and expert assistance for early-stage innovators to take their next steps.

Faculty and Ecosystems

Finally, two principles are paramount for stimulating innovation and entrepreneurship at universities. The first is that *the faculty members are the key agents*. In addition to leading research projects, they teach and influence

Proof of Concept Centers

What early-stage entrepreneurs at universities often need most is seed funding and expert assistance to literally "prove the concepts" they'd like to bring to market. The work may entail developing a research technology further, perhaps to a working prototype, and/or studying markets to see if the business concept will fly. A new type of center—the proof of concept center—has emerged to help with this work. Two examples are the William J. von Liebig Center at the University of California, San Diego, founded in 2001, and the Deshpande Center at MIT, founded in 2002.

Each center takes proposals from its university, mostly from engineering research faculty, on a competitive basis. Those selected (by internal and external commercial experts) are given modest but crucial seed grants (up to $50,000 at UCSD, $75,000 at MIT) for proof of concept work—which the researchers can pursue in their own labs and offices without moving into any central, shared space. For expert assistance, the von Liebig Center has a paid, part-time staff of experienced advisors, while the Deshpande Center draws from a pool of expert volunteers, plus graduate-student teams, that help with feasibility studies. Both centers also offer education programs and conferences, and Deshpande has larger follow-on grants for ventures of high promise.

Results thus far suggest that the proof of concept center is a good model. By early 2008, the two centers combined had given out nearly $10 million in grants, producing twenty-six spinout companies that raised an additional $159 million in private investment. And the process is useful even when it demonstrates that a research idea will not be viable. The researcher can move on quickly to other work, better informed about what could help make the next idea a winner.

Visit *kauffman.org/poc* to download a white paper on the centers.

students, chair departments and programs, and tend to be active in both university and civic affairs. They cannot be viewed as mere "performers" of research that might be worth something. They are the people who can shape the entrepreneurial culture of a university, of an entire region—or not.

. . . the faculty members are the key agents . . . They are the people who can shape the entrepreneurial culture of a university, of an entire region—or not.

In high-growth regions with highly entrepreneurial universities, the following tend to be true of the faculty. They have frequent and extensive contacts with private industry, which attunes them to thinking in terms of practical value creation while enabling them to share their own expertise. And they operate under university policies that encourage such activities, rather than laboring against policies that draw barriers separating the academic from the commercial.

The other principle for stimulating entrepreneurship at universities is that *there is no single model for success*. This brief essay has stated some basic elements of success, but they may need to be applied in different ways or mixtures. What works best may depend on a university's research strengths, the nature of the related industries, the nature of the region (big city, rural, etc.), and other variables. The only common thread is the need for a well-developed ecosystem of innovation. Magic bullets may score occasional hits, but ecosystems flourish with many pathways to the commercial market.

How a Dose of Reality Can Make Science More Visionary

E.A. FITZGERALD, Ph.D.
Merton C. Flemings–SMA Professor of Materials Engineering, MIT

When we think about how to get more benefit from scientific research at our universities, we usually focus on the back end of the research pipeline: on how to move new technologies "out of the labs" and into the marketplace. We have created an entire infrastructure for this purpose, from technology transfer offices to startup incubators, venture funds, and more. Certainly these efforts are useful, but still the yield is often lower than expected. Perhaps it is time to ask what is seldom asked:

> *How do we know that university scientists are working on the best possible research projects to begin with? The ones with the greatest chances of bearing the most fruit?*

In fact, we do not have good mechanisms for seeing that promising research is pursued while blind alleys are avoided. Mechanisms that once existed have atrophied, as the structure of research in this country has changed. And though we haven't regressed to a stage where mad scientists are wasting their time trying to transmute lead to gold, our research ecosystem needs better methods of reality testing, and reality attunement.

The Great Shift

University research has grown tremendously since World War II as federal funding for it has ballooned to a total of about $30 billion per year. This isn't nearly as much as the private sector spends on research and development (R&D) in companies. But university research has come to have great strategic importance, due to the shifting nature of corporate R&D.

Here's why: Big firms once did a lot of basic research, the kind that might not show results for ten to fifteen years, if ever, but could produce fundamental advances. In the first few postwar decades, AT&T's Bell Laboratories developed (among other things) the transistor, the first modern solar cell, and the UNIX operating system. Companies at that time could afford to invest in basic research. For years, firms like IBM, Xerox, and Kodak had near-monopolies in their industries.

Then came a more competitive economy, with new foreign and domestic entrants. Pressure on profits drove firms to shift their focus to applied R&D, with shorter time horizons: three to five years, or even two to three. More and more, basic research migrated to the universities, where the federal funds and the labs were growing. What did not survive the migration were the reality-sensing mechanisms.

The Non-Reality Loop

Since the mid-1980s, I have had a front-line view of this shift, first as a graduate student in university research, then working for six years at Bell Labs, and since 1994 on the faculty at MIT, where I have kept touch with industry through startups and related activity. Following are some things I have observed.

Under the old system, basic research at companies was grounded in practicality. The R&D lab was embedded in an organization embedded in the market. Within the lab there would be a subgroup of people doing only basic research and thinking ten to fifteen years into the future, but they were surrounded by applied research people thinking and working shorter-term. From this, scientists could gain a good sense of what it takes to literally "apply" a lab-grade technology—and of what kinds of factors signaled whether a technology was likely to be feasible and marketable.

Industry researchers also transmitted signals to the rest of the research community. Their very presence served as a control on hazy thinking . . .

Industry researchers also transmitted signals to the rest of the research community. They sat on the boards of professional societies and attended conferences, along with university scientists. Their very presence served as a control on hazy thinking, as a young professor who over-stated the potential of a new research technology might find a senior scientist from an industry lab standing up to tell everyone why it would never fly.

Federal funding seemed to respond to the signals, too. When I was at Bell Labs, I noticed that after the Labs made a big discovery, the government would follow with BAAs (broad agency announcements) for funding in that area. Government program officers used these discoveries as indicators of emerging fields that were likely to grow, and would thus require more research and skilled students from the campuses.

Today, with the decline of basic research in industry, this has all changed. It is mostly academic scientists who direct the research societies and attend scientific conferences. And funding for basic science is often driven by a sort of university-government feedback loop. Professors who have a new line of research will create

momentum for it via the Internet and other sales channels, such as conferences. The government uses the resulting excitement as an indicator, releasing BAAs. As the funds begin to flow, the work expands and momentum builds further.

The danger is that this self-reinforcing loop can become a non-reality loop. More than once, in my own contacts with industry, I have mentioned the latest university research that's supposed to change the world and gotten little more than a laugh and a head-shake. But the knowledgeable skeptics are now outside the loop, and research that may never fly can spend years trying to.

Unrealistic thinking also can have harmful ripple effects, even when the research is promising. For instance an important channel for moving university technology to market is through venture-funded spinout companies, but often, research that is far from ready is moved prematurely. This happened in my discipline, materials science, when nanotechnology became a hot new field. Professors rushed to start companies, persuading venture investors that all manner of commercial nano-materials were just around the corner. Basic research that might well pay off in a decade or so was now expected to pay returns in a couple of years.

Of course many venture funds got burned. And after repeated burnings, many funds now invest mainly in more proven later-stage companies, with the result that venture capital isn't really "venture" any more. Worthy startups may find it harder to get funding; a key part of the ecosystem has been weakened.

Solutions and Caveats

What can be done? The single most useful measure—however it can be implemented—is simply for university scientists to have ongoing, one-to-one interactions with people in industry. This means contact with people who know

what's involved in making and using things, from cost and competitive factors to the many practical constraints (and opportunities!) that can arise when turning ideas into reality.

One caveat: Any attempt to make research more "practical" must not drive scientists toward shorter-term thinking, aimed only at incremental advances. We need long-term, visionary thinkers. The trick is to provide these highly creative people with the signals, and the knowledge, that will enable them to envision more intelligently.

Any attempt to make research more "practical" must not drive scientists toward shorter-term thinking, aimed only at incremental advances.

And there is an underlying need for a change of mindset in the science community. We've fallen too much under the spell of the limitless possibilities of science. Our funds and our human capital, though bountiful, are limited. Every problem we might want to solve, from making a more efficient solar cell to curing a disease, has many possible research approaches. We can never explore them all. With more choices than resources, we need to think and act like wise investors—placing some bets on long shots, but trying to build a balanced portfolio in which the investment in each line of research is proportional to the risks and rewards.

At present, scientists often behave more like interest groups, and government more as a "supporter" of science than as a demanding customer or investor. We must do better. Despite my criticisms, the new research environment has great virtues. Today's open innovation model—in which the whole chain from research to application doesn't have to take place within a firm—is indeed highly open to ideas from many players, at all stages. If we can keep the research well focused, this new system will be powerful. If not, the torch of innovation may pass to others.

Accelerating Early-Stage Innovations for Market

An Interview with

SOREN JONAS BRUUN

Chief Executive Officer and Founder, 1st Corporate Technologies Ltd.

HANSON GIFFORD

President and Chief Executive Officer, The Foundry

Succeeding as an entrepreneur requires both a novel idea and the business acumen to bring it to market. Taking an innovative product from concept to market is a daunting task, especially for people whose first passion is science, not business. Simply knowing where to find venture capital can be a mystery.

An emerging model, called "accelerators," is helping early-stage entrepreneurs reach investors and prepare to launch new products into wide distribution. But not all accelerators are alike. Depending on the business sector in which companies seek to grow, the path from early-stage entrepreneurship to maturity may follow various routes. Soren Jonas Bruun and Hanson Gifford run business accelerators that use very different models to help promising companies navigate the challenging path to market.

Bruun's 1st Corporate Technologies, or 1CT, based in London, works primarily with European growth firms, facilitating exits with international partners. Gifford's California-based The Foundry, focuses on developing innovations in medical devices. Here they share their insights about their individual models, how business accelerators work best, and what early-stage entrepreneurs should know about the process of getting to market.

Tell us a bit about how your model developed.

Gifford: We began in 1998 with about $4 million from a few angel investors. We were able to start four companies—Evalve, Concentric Medical, Emphasys Medical, and First to File, a patent-prosecuting dot-com.

We continue to refine the model. These days we raise money in advance for just one company at a time. That focuses The Foundry and our investors on identifying and creating the best company we can. If there's an idea that we or our investors are not excited about, we don't work on it very long. We find that getting all of the involved parties on the same side of the table as quickly as possible, while retaining the flexibility to evolve and optimize the new company's focus, is a key to creating better companies.

Bruun: While we don't take over partner companies, we make our skills available to provide coaching, advice, and day-to-day assistance—exerting influence at the same time as providing the funds necessary to kick-start the international growth process. More often than not, we keep the current management team in place and add our own seasoned professionals to the mix. The great benefit of this from the larger perspective is that we are always building new entrepreneurs.

One of our big strengths is introducing mature business development expertise to a technology-centric business and also plugging these small businesses into a wide grid of opportunities for international expansion. In short-hand, we refer to it as "know-how and know-who." In certain segments, access to two customers on the other side of the Atlantic can double a company's growth. We aim to deliver this access, and also help entrepreneurs develop and package their product to match the demands of potential customers.

How do you decide where to focus your efforts—which companies and technologies to work with?

Bruun: We have a "dating before marriage" philosophy. We work with the companies for three or four months, help them get their act together, and figure out if it's in our best interest and the company's best interest for us to work together. In this process, we work with management to align our goals, build the plan, and attach the right experts. Most importantly, we talk to the potential buyers and get their thumbs-up. If it is all good, then we invest.

Gifford: We go after big-market opportunities and look for technologies that are dramatically better, so that clinicians will be motivated to adopt them. We then rapidly prototype and test our solution to prove feasibility. We spend a great deal of time early on looking at the intellectual property landscape, as well as the clinical trial plan, regulatory timeline, cost, and market dynamics. And, although we assume that all of our companies will need to succeed on their own, we do analyze whether there are likely acquirers in this area that should be excited about what we're doing. Beyond that, it's partly what projects we are curious and excited about.

About 1st Corporate Technologies

Working closely with more than seventy-five international project partners, London-based 1CT provides experts and capital to take emerging technology companies to their full potential. The company works primarily with European growth firms, adding value by offering tailored resources and access to strategic players, and helping its customers to a faster and larger exit. For more information, visit *1corptech.com.*

About The Foundry

The Foundry is the premier medical device incubator for inventors to rapidly transform their concepts into companies. Led by a highly experienced team of technical and senior executives who have, prior to joining The Foundry, created medical device businesses generating more than $2.5 billion of value for their founders and investors, The Foundry is a full-capability incubator with resources spanning all functional areas and a fully equipped medical device development facility. For more information, visit *the-foundry.com.*

What's your take on the scalability of your model?

Gifford: It doesn't feel very scalable to me, frankly. You need a small group to invent great solutions, and then dig in and prioritize the different ideas. I don't think that, instead of five people starting one company a year, you could have fifty people starting ten companies a year, and still maintain the same intensity of focus and quality of results. It just wouldn't be the same.

Bruun: We've actually structured ourselves to be scalable, but without having a fixed organization. We have four equity partners and seven employees and executives. These are complemented by seventy-five international project partners and more than 200 international experts. With this extended network, we can scale our business to work with a wide range of growth companies and always have access to experts who know particular market areas.

I don't expect to bat a thousand, but I do believe that we'll provide a better success rate than these entrepreneurs otherwise would have without us.

How do you measure success in your ventures?

Gifford: I would say that the most important thing is to create new technologies that really help patients, and so far we are succeeding in that regard. Secondly, we are creating challenging and fulfilling jobs for hundreds of people.

From a financial standpoint, I don't expect to bat a thousand, but I do believe that we'll provide a better success rate than these entrepreneurs otherwise would have without us. We've had one initial public offering, one acquisition that brought a very immediate nice return, and the others are on a trajectory

toward great success commercially as well as clinically. The timelines for clinical approval of medical devices have lengthened over the past decade, so we need to be patient with these companies as they develop. I am optimistic that we'll be able to look back and say that we did quite well.

Bruun: We're pleased that we've completed twelve exits since 2005 with an aggregate exit value of about $350 million. Typically, 1CT portfolio companies grow in value by a factor of three or more during the time in which we are involved with them. To date, seven out of every ten partnerships have resulted in a successful exit. We've facilitated transactions involving very prestigious buyers—Adobe, Cisco, VMware, IBM.

Much of our work has been with Danish companies. We're particularly proud to have the opportunity to partner with the Danish government's GazelleGrowth program *(gazellegrowth.com)*. It's designed to find Denmark's forty most compelling companies and help introduce them to the international market, particularly the U.S. market.

What do budding entrepreneurs need to know that may not be obvious?

Bruun: I think there are several levers that make an entrepreneurial firm more successful.

First, entrepreneurs need access to the right knowledge. They need to know which doors to knock on and how to use the knowledge that is out there. If you have that knowledge, it will double your chance of success. This sounds simple, but it's not. It's easy for a company to become its own bottleneck—with a potentially industry-changing product held back by limited knowledge. That's where our experts are very useful.

The second lever is short technology lifespans. Technology is constantly evolving; it won't last for seven years. Companies need to think about an exit in two or three years to make it more likely that the technology will succeed. Entrepreneurs and their shareholders should agree to this before they start. And they need to understand where they're going—to define a goal. And that goes back to knowledge: If you have the knowledge, then you can establish a realistic goal.

And, finally, entrepreneurs should understand how to reach their goal. They should have a roadmap that gets them to the endpoint they envision. Again, this is where expertise of the sort we offer can prove vital.

Gifford: I think one of the things that we're very acutely aware of—which may elude some early-stage entrepreneurs—is that getting the company started is really just the beginning. There's a long pathway of development, and we aren't eager to start something that we don't really believe in, because we know how long we're going to be at it.

The experience of inventing a new idea is really fun, really fulfilling. As a result, inventors often fall in love with their first idea because of the feeling you get from having come up with it. People sometimes stop there. You need to have confidence in yourself to step back and be really critical of that idea, and ask yourself ten different ways, "What's wrong with that idea? What alternatives or improvements would make it even more successful?" Once you answer all those questions, eventually you will refine your concept to something that's really good and protectable, and has legs to succeed clinically and commercially. So take the time to be critical and come up with an idea even better than the one you already have.

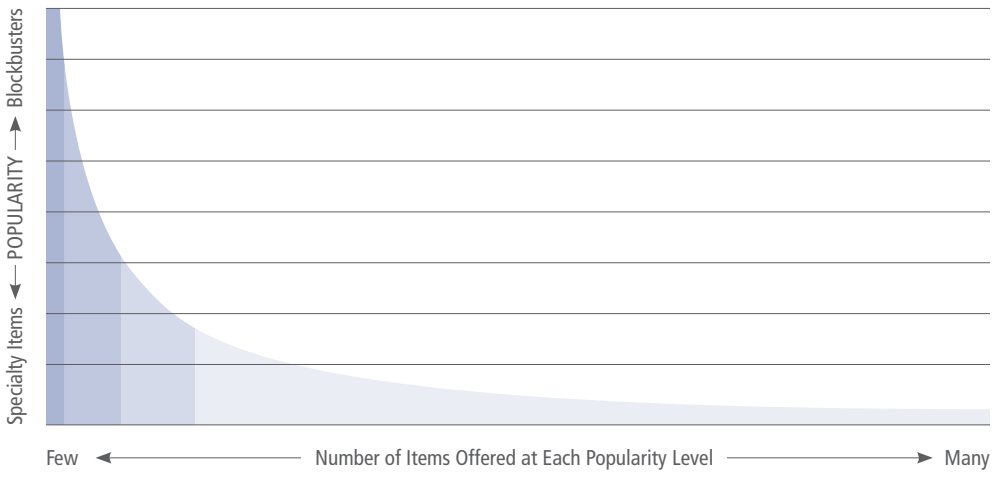
Advancing Innovation Along the Long Tail

LAURA DORIVAL PAGLIONE
Director, Kauffman Innovation Network, Inc.

Since the advent of online retailing, we all have been amazed at what we could find on Web sites like Amazon. The online selection of books, recorded music, and other goods is much larger than in physical retail stores. In 2004, in a seminal article in *Wired* magazine, editor-in-chief Chris Anderson described how this phenomenon was changing the media and entertainment industries.

Bricks-and-mortar outlets, limited by cost and physical constraints, can offer only the items that seem most likely to be reliable sellers, Anderson wrote. What the

THE LONG TAIL PHENOMENON



online retailers had shown was that huge potential markets were being missed by this approach. He noted that a typical chain bookstore carries 130,000 titles, which may sound like a lot, "yet more than half of Amazon's book sales come from outside its top 130,000 titles." Similarly, other sites were finding plenty of people who wanted music and movies that physical outlets didn't carry.

Anderson's article was titled "The Long Tail." Imagine a graph showing the number of things offered at each popularity level with the few, very popular hits to the left, and a very long tail representing the plentiful, but less popular "non-hits" or specialty items (see previous page). No item in the tail is a blockbuster, but the combined effect is a paradigm-buster. Instead of narrow markets ruled by "the tyranny of the hit" (Anderson's term for the old focus on best-sellers), we get markets where non-hits and specialty goods can flourish as well.

Today, a Kauffman Foundation initiative is applying the power of the long-tail model to some of the nation's most important products: research technologies from universities.

iBridge℠ Network: Meeting a Need in Technology Transfer

The iBridge℠ Network is managed by Kauffman Innovation Network, Inc., a not-for-profit offshoot of the Foundation created to advance innovations through education about best practices, research, and fellowships. Its Web site *(iBridgeNetwork.org)* serves as an aggregator of innovations by researchers at universities across the United States. These inventions and discoveries range from software and electronic devices to new chemical compounds and materials.

Typically, university technology transfer offices (TTOs) license such innovations for use. But one could say a TTO is equivalent to a bricks-and-mortar store. With limited resources, high transaction costs, and sometimes pressure to be a university profit center, most offices are driven to focus on the innovations considered potential hits. Innovations that have merit, but aren't regarded as big-hit material, may not be marketed actively at all.

In the past, untold thousands of technologies have gotten little or no attention. Many are "research tools," useful mainly to other scientists. These include items like special-purpose software that you may never want for your home PC, but that can be used to run experiments or analyze results, or biomedical compounds that will not be the next wonder drugs but might help to produce them. Just getting more innovations of this type into use could give a significant boost to scientific research and, eventually, to society and the economy.

Also, there may be some hits hidden in this long tail—innovations that could reach the mass market if they were noticed more widely and developed further. We've all seen books or heard music that rose from obscurity to the mainstream after being jump-started by long-tail marketing on the Web. Could something similar be done for technological innovation? It so happened that, just when Chris Anderson was writing his article, the Kauffman Foundation was moving into action.

Early Results and Ultimate Vision

With seven pilot universities, the iBridge℠ Network launched its Web site in 2005. After a redesign based on the pilot experience, the site was re-launched early in 2007. By the spring of 2008, nearly forty university campuses were posting innovations on the iBridge℠ site, including many of the nation's leading

public and private research universities, plus a small but growing number of independent, nonprofit research institutes.

Innovations available on the iBridge℠ Web site have passed the 3,000 mark—a tail of considerable length—and actual licensing and use have been growing, too. Most traffic has, indeed, been the dissemination of research tools, with users reporting that the iBridge℠ Web site greatly enhances current and past methods of moving innovations. Researchers have long "marketed" their work informally, through personal networks or at conferences, and through the TTOs. But this is a limited

How the iBridge℠ Network Can Help: One Story from the Long Tail

Professor Linda Restifo, a neurobiologist at the University of Arizona, is doing research that hasn't yet made headlines but someday could. The goal is the discovery of drugs for treating intellectual disability. Although the work is early-stage, Restifo and her team have created a research tool that could accelerate it greatly. And the iBridge℠ Web site has accelerated the process of getting the tool into the hands of other scientists.

The tool is a software program called NeuronMetrics. In disabilities like Down's or fetal alcohol syndrome, neurons in the brain fail to develop properly. To see how neurons grow wrong, and how they might respond to various treatments, experimenters can study samples of brain tissue from fruit flies, our genetic cousins. But the photo images of the results are so complex that they're hard to analyze. Neurons have long, intricate branches for exchanging signals with their neighbors. Trying to assess the state (and thus the health) of tangled webs of "neurite arbors" can be time-consuming with only a modest number of images, and prohibitive with many.

NeuronMetrics is image-analysis software that automates much of the task. Developed by Restifo's team with the help of computer scientists at the University of Arizona, it was posted on the iBridge℠ Web site early in 2007. As of May 2008, sixty-five other research teams had licensed and downloaded the software, with more than 200 expressing interest in or asking for materials on NeuronMetrics. That is a very good dissemination rate for such a technology—which, by the way, can have uses beyond the study of intellectual disability.

For now, Restifo is hoping mainly to build progress toward her original aim of "enhancing brain function" in affected children, instead of just "assuming that nothing can be done." For testimonials from Restifo and her university about the value of the iBridge℠ Network, visit *iBridgeNetwork.org*.

approach to reaching potential users of research, technologies, or other innovations. Researchers are finding that the iBridge℠ Web site more than augments their previous sources, such as scientific journals and Internet search engines.

The iBridge℠ site is a one-stop shop, easy for all to use. Visitors can browse by category to read about innovations, and the TTOs do not have to laboriously process every transaction. Technologies can be offered with simple click-to-agree licenses. Innovations that consist of software or databases sometimes can be downloaded directly; others can be ordered online.

What is really being built is a Web-based community of innovators, which can link with other sites and communities.

The iBridge℠ Network site is not the first or only of its kind, but it has become a preeminent one. Also, the best long-tail markets are more than transaction mechanisms; they are highly participatory, and the iBridge℠ Web site is growing in that respect. One feature is the iBridge℠ Conversations blog, for news and online discussion related to university innovation. The idea is to connect people and organizations, transfer knowledge through innovation licensing, and spur not just transactions, but collaborations. What is really being built is a Web-based community of innovators, which can link with other sites and communities. The ultimate vision is a new meta-network for advancing innovation everywhere.

Open Innovation:

R_X for Improved Human Health

JOHN WILBANKS
Vice President, Science Commons project at Creative Commons

It's a term being used a lot these days. Open innovation (OI) encapsulates the power of the informed user to drive innovation in new product design. It enables users to build new products that suit themselves, as opposed to manufacturers, which develop new products for profit.

This shift to user-driven innovation leads to explosive growth in products and features in disciplines ranging from "Threadless," a community of t-shirt designers and buyers, to a group of engineers building the best kite-surfing kits on the market. In each area where it is observed, OI democratizes innovation processes—shifting enormous control to the user—and has explosive power when combined with digital communications networks.

Threadless epitomizes these elements of OI. This community of people loves shirts, from designing them, to buying them, to talking about them. Thousands of Threadless users spend their free time creating t-shirt designs—artistic, funny, ironic, textual, visual—and submitting those designs in standard formats, free of charge, to the group's Web-based forum for voting by the other users. Winning designs are printed in limited quantities, then made available for sale back to the community. The company behind the process makes a tidy profit by dint of

creating and maintaining the community through trust and transparency, but the innovation and design happen at the user level, not the manufacturer level.

This user empowerment is recapitulated in other genres, including content, with the advent of ubiquitous digital music and photography, and even in engineering fields like robotics and materials science.

A Foundation for Open Innovation

Open innovation isn't a "natural" outcome of digital systems and users, however. It sits on a set of pre-conditions, fundamental infrastructural elements that allow OI to emerge in some systems faster than in others.

OI starts with interoperable information and low transaction costs. Digital content is a good example: We use it effortlessly today. Think about taking a digital picture on your Cape Cod vacation and sending it to a Web-based photo-sharing site so your family in another state can see your amazing view of the water. It's easy. You can even do it using your phone.

OI democratizes innovation processes—shifting enormous control to the user—and has explosive power when combined with digital communications networks.

This ease is possible for two key reasons: First, most digital cameras produce standard file formats that most computers can read, manipulate, and upload; and second, there are essentially no fees imposed on camera users as they read, manipulate, and upload files—or on the users who view the pictures on the Web. The pictures represent interoperable information available at low transaction costs. And they result in even more innovations: user-created calendars, picture books, postage stamps, and even more t-shirts.

However, user-driven innovation can be strangled into oblivion if the information is neither interoperable nor available at low transaction costs. The most obvious example of this is the way technical and legal decisions either enable or disable OI: If users don't put the photos on the Web, the whole process is stillborn. If users don't grant rights in advance, creative re-use becomes illegal, and the process dies.

Thanks to the access principle, business explodes when users can spend their time and money innovating, not negotiating permission to use the network. It's why the Web, despite its significant disadvantages in functionality and user base at launch compared to Prodigy or AOL, crushed both of them in only a few years. The access principle, as applied in the network, fostered innovation because it shifted power from the owners to the network users.

Applying Open Innovation in New Ways

Using the access principle's lessons, we have the opportunity to bring the gains we've seen in user-driven commerce and culture to pursue improved human health. We can finally begin to attack the persistent tragedies of rare and neglected diseases, to understand how drugs really work, and to understand how to prevent disease. It will happen when we stop being drug *consumers* who passively accept manufacturers' innovations and instead become *user-innovators* of health care, driving the markets ourselves. But this is not what we see happening. The knowledge network isn't emerging to create these opportunities.

The time has come to change the way we cure disease. We are no longer asking whether a gene or a molecule is critical to a particular biological process; rather, we are discovering whole networks of molecular and cellular interactions that contribute to disease. And, soon, we will have such information about individuals, not just the population as a whole. Biomedical knowledge is expanding rapidly—

yet the system to capture and translate that knowledge into saving human lives still relies on an antiquated and risky strategy of focusing the vast resources of a few pharmaceutical companies on just a handful of diseases. We need a system that empowers the individual to innovate.

. . . we have the opportunity to bring the gains we've seen in user-driven commerce and culture to pursue improved human health.

This goal will require investment in creating the pre-conditions for user-driven innovation. The information in life sciences, health care, and drug discovery is far from interoperable, nor is it available at low transaction costs. Those roadblocks frustrate the emergence of innovative, user-centric systems, which means that our open systems serve us far better in the search for shoes than in the search for cures.

The science-user network differs from culture and commerce: It is grounded in pre-existing knowledge that is, in many cases, already locked up like the scholarly literature or the research tools in scientists' freezers. It will require re-formatting something that already is under control—legally and technically, we must change the network infrastructure to foment a user-driven revolution and explosion in value.

Transforming Health Care Through Open Innovation

Five key elements are required: a network, a user base, a set of standard technologies, a low level of legal control, and a lot of content. The Internet and the Web offer the technical foundation, but we need more robust systems to manage the scientific research demands. We need the user base of scientists to dramatically increase, flinging open the door to include anyone who wants in, and we need tools that are simple enough for an interested non-scientist to start asking questions and doing research. We have standard technologies, but we need new systems that let the home user innovate

About the Commons

Science Commons: Making the Web Work for Science

Science Commons designs strategies and tools for faster, more efficient Web-enabled scientific research. It identifies unnecessary barriers to research, crafts policy guidelines and legal agreements to lower those barriers, and develops technology to make research data and materials easier to find and use.

Its goal is to speed the translation of data into discovery—unlocking the value of research so more people can benefit from the work scientists are doing. For more information, visit *sciencecommons.org*.

Creative Commons: Using Private Rights to Create Public Goods

Creative Commons provides free tools that let authors, scientists, artists, and educators mark their creative work with the freedoms they want it to carry. It sets creative works free for certain uses. Like the free software and open-source movements, Creative Commons' ends are cooperative and community-minded, but its means are voluntary and libertarian. It offers creators a way to protect their works while encouraging certain uses of them—to declare "some rights reserved." Visit *creativecommons.org* for more information.

at a level comparable to an MIT scientist. We have policies that lower the legal barriers in theory, but we need funders to create incentives for individual scientists to share information and tools in reality.

And, though we have content—lots and lots of content—we need a lot more, coupled with open-source knowledge management systems and community-driven innovation. Only through the mixture of content, community, and tools can we make the alchemical transformation of raw data into usable knowledge and a scalable process.

Through this transformation, we will create a world of users who drive innovation in our approach to drug discovery and health care. Our goal should be to enable life sciences innovation that we cannot even imagine, that we did not design for. We should constantly focus on creating systems with explosive potential for innovation, and we should draw our inspirations from the systems that have proven to carry that potential.

My organization, Science Commons, is among a set of organizations working at this intersection of law, technology, policy, and business. We join a network of organizations, including the iBridge℠ Network, Innocentive, CollabRx, Public Library of Science, BioMed Central, Coriell Cell Culture Repository, Addgene, and more. The Ewing Marion Kauffman Foundation is a common thread throughout this network. We're all working to shift the innovation engines to the users. It's time to bring open collaboration and open innovation systems out of the social network and into the cause of human health.

A Cure for the Drug Discovery Gap

FRANK L. DOUGLAS, Ph.D., M.D.
Partner, Pure Tech Ventures; Founder, MIT Center for Biomedical Innovation;
Senior Fellow, Ewing Marion Kauffman Foundation

Recently, the Kauffman Foundation launched a new focus on translational medicine—the process of turning scientific breakthroughs in the lab into new drugs and other patient therapies, often delivered by startup companies.

Despite the growing sophistication and promise of health care technology research, fewer and fewer breakthrough ideas are finding their way out of research institutions and into the hands of experienced clinicians and medical product development teams. Patients suffer as a result, because promising research and innovation are not being translated into new treatments.

Progress is being stifled by a crucial gap in the current research and development pipeline: expertise and funding for early-stage innovations. Many of the biotech startups, academic institutions, and government research centers that perform critical early-stage work do not have the resources to move their breakthroughs further along the commercialization pipeline. At the same time, large pharmaceutical companies and venture capitalists are reluctant to invest in early-stage research that lacks proven market potential and requires a longer period of time to produce returns on investment. And federal investment in medical research is tight—the 2008 budget for the National Institutes of Health is only about 1 percent higher than its 2007 budget.

In the following essay, Frank Douglas, a senior fellow at the Kauffman Foundation and a physician with extensive experience in pharmaceutical innovation and research, sheds light on the lengthy timeframe between breakthrough discoveries and new treatment options. He also explores one idea for catalyzing medical research to help bridge the gap between the laboratory and the bedside.

Several years ago, I coauthored (with Peter Tolman and Malcolm McKenzie of the strategy consulting firm, Monitor) an article for the medicine and business magazine *In Vivo*. Our article tackled the question of how to spend a billion dollars in research and development. At the time, the highest yearly R&D budget among pharmaceutical companies was $547 million. And most companies, regardless of the size of their budgets, aspired to produce two discoveries capable of being approved by the FDA as a "new chemical entity" each year. More than ten years later, in spite of R&D budgets that routinely range between $3 billion and $8 billion a year, few companies have been able to reach this benchmark.

This lack of productivity has resulted in a mixture of public consternation and more vocal calls for action by government agencies.

This lack of productivity has resulted in a mixture of public consternation and more vocal calls for action by government agencies. The deciphering of the human genome eighteen years ago increased hope that a genomics revolution would accelerate the discovery of new drugs. Yet few genome-based drugs have made it to market.

Why this delay in getting potential therapies from the laboratory to the patient? Noted economist Manuel Trajtenberg described two timeframes that are crucial to realizing the potential of a fundamentally new technology. One is the time

from discovery to the horizon—when new products are actually developed. The second is the time from discovery to application—when a new concept can be turned into a tool that can be used to produce a commercial product. These timeframes are clearly evident in the use of new technologies to find novel drugs.

The horizon timeframe in drug discovery and development comprises several critical steps, including the selection of a target receptor or enzyme; the molecular validation of the relevance of that target to the disease; the identification of a lead compound that is selectively active against the target; the optimization of that compound through pharmacological, toxicological, and

New R&D Models Gaining Ground

The *In Vivo* article I authored with Tolman and McKenzie pointed out that the major companies pursued one of two R&D models, which we called "scale-based" and "capabilities-based." Scale-based organizations sought to have all research and development disciplines at-scale in-house. Capabilities-based organizations sought to have research and early development at-scale in-house, but in-house late-stage development was restricted to critical capabilities, with other development work performed by Contract Research Organizations (CROs).

Today, most companies are moving away from a scale-based R&D organization and embracing a capabilities-based organization, for reasons including the overall cost of R&D; the growth of biotechnology companies, many of which do not have the resources and experience to perform the extensive late-stage clinical development programs that are needed for regulatory approval of a drug; the proliferation of CROs; the rise of low-cost alternatives in India and China; and the increasing government-sponsored (NIH and FDA), academic-industry consortia to find biomarkers or develop special models that will improve the ability to predict efficacy and safety.

A potential third model is the "discovery cluster." In this model, large pharmaceutical companies perform their discovery through loose consortia of academic and institute laboratories, and small biotech companies focused on technology platforms or therapeutic areas, each of which has common goals and specified deliverables for integration and further development by the large pharmaceutical company.

Capabilities-based R&D organizations and discovery clusters can improve the development of novel drugs, but they're not sufficient to accelerate the horizon time.

human *in vivo* studies (conducted on living patients); the clinical proof of the concept in a target patient population; and, finally, the large clinical trials needed to demonstrate efficacy and appropriate safety (the final validation of the target) in patients. This process takes, on average, ten to thirteen years—and only then is the new therapy submitted to regulatory agents for marketing approval.

The application timeframe, on the other hand, can be as little as a few months from discovery to impact. For example, the decoding of the genome enabled the rapid growth of proteomics, the study of proteins, and metabolomics, which are integral to cell metabolism. Proteomics, genomics, and their application to systems biology are having a significant impact on identification and validation of new targets. Pharmacogenomics and pharmacogenetics are improving the understanding of patient susceptibility to specific pharmacological agents.

All of these "omics" are contributing to finding biomarkers that can potentially predict and monitor the efficacy or safety of any specific drug candidate. However, it will require the coordinated and simultaneous application of all of these technologies against a disease to significantly shorten the overall horizon time—the time it takes to create new therapies.

How can we facilitate a shortening of the horizon time?

What we need is a challenging, overarching problem that clearly requires the coordinated engagement of academia, large pharmaceutical companies, therapeutic- and technology-based biotechnology companies, and hospitals and specialized clinics—a challenge such as curing cancer.

Cancer has common features, but also requisite complexity because many mechanisms drive the disease. It also has a combination of genetic and environmental factors that contribute to its etiology or cause, as well as a high personal and societal burden. And, as yet, there are few adequate therapies for treating cancer.

We often hear officials and advocates talk about our nation's fight against cancer, but a potentially more effective solution would be to wage the fight in a state with the required medical-scientific infrastructure to accommodate it. A state such as Massachusetts, which has more than 300 biotech companies and startups, several

Translational Medicine Alliance Tackles Bench to Bedside Challenges

Overcoming the obstacles facing translational medicine requires cooperation among all major stakeholders—the medical product development industry, philanthropies and research-oriented nonprofits, academia, the investment community, and the federal government. In 2007, the Kauffman Foundation joined a host of organizations active in the field of translational medicine to launch the Translational Medicine Alliance. The goal of the Alliance is to tap into thought leaders' best ideas and develop an integrated strategy to support and advance the most promising technologies.

The Alliance's first national forum was held in September 2007 to facilitate discussions about translational issues and to discuss how stakeholders can work together to accelerate commercialization of medical products. Participants discussed the critical areas of funding, R&D collaboration, education, and institutional policy. They also examined specific translational issues in various therapeutic areas, as well as medical devices, and new tools and technologies to facilitate research.

Through ongoing collaboration, the Translational Medicine Alliance seeks to build connections between stakeholders in the field, helping to raise awareness of the challenges faced in each sector (academic, corporate, nonprofit, government, etc.), while devising innovative solutions to overcome them. Members of the Alliance also will advocate for greater accountability from government and research institutions, to make the translation of breakthrough research into new therapies the benchmark of success. And the Translational Medicine Alliance will keep the most important stakeholders—patients—at the center of the discussion. The duty of everyone involved in translational medicine is to find creative and expeditious ways to save and improve patients' lives.

For more information on the Translational Medicine Alliance, visit *translationalmedicinealliance.org.*

renowned academic institutions and schools, renowned hospitals and clinical centers, and research centers of large pharmaceutical companies, would be an excellent candidate.

A real breakthrough in the horizon time for the cure of cancer could be achieved if, for example, Massachusetts became the “Cure Cancer within a Decade” state. It could do this by appointing a Cancer Czar who would bring together multiple organizations to work collaboratively to solve specific cancers. This would enable standardization of research methods and assays, and accelerate the adoption of, for example, personalized health records, and stratified or personalized medicine.

While we cannot predict the outcome of such a venture, it is reasonable to believe that a concerted effort, with a widely agreed-upon goal on a fixed timeline, would spur the kind of coordinated engagement necessary to accelerate the development of new treatments and finally bring the promise of genomic medicine to the patient’s bedside.

Innovation: Catalyst or Consequence of Fast Growth?

MICHAEL LEVIN

Chairman and Chief Executive Officer, Titan Steel Corporation; Entrepreneur-in-Residence, Ewing Marion Kauffman Foundation

Pop quiz, take your pencils out!

Question One: Does high-tech drive high-growth and extraordinary equity value?

Partially. Think about the following business ideas: a new twist to providing Medicare-covered prescriptions, an accumulator of clients for DirecTV, a temp accounting service, a claims handler for insurance companies, and a real estate fund.

Question Two: How many of these firms are high-tech corporate stars?

None. But they are all superstars when it comes to growth. Hospital Partners of America, Red Ventures, Callaway Partners, Global Risk Solutions, and Noble Investment Group are listed first through fifth on the current Inc. 5,000, which ranks America's fastest-growing private firms.

Given these examples, why is it that technology, technology transfer, and intellectual property continue to be singled out as the *sine qua non* for high-impact economic growth? We find the plain truth is that growth and value emerge from technology and process in a cycle of innovation, starting with Process or Technology

Innovation, leading to Opportunity Recognition, leading to Business Creation, leading to Further Innovation, leading to Enterprise Value.

Pervasive attention is given to productivity growth derived from plug-in-enhanced technology, such as laser welding or robotics—but service sector gains and business creations, like many of those listed on the Inc. 5,000, are where most of the fast-growth activity occurs. Overall, the entrepreneur trumps technology in creating value. Or, put another way, clever science doesn't make a business great; *people* make a business great.

Overall, the entrepreneur trumps technology in creating value . . . clever science doesn't make a business great; *people* make a business great.

Imagine innovation as either a catalyst for fast growth or a consequence; the former is typified by electric cars using advanced battery technology and the latter in Netflix, where technology was exploited to deliver movies in a new way. Studies show that the explosive blast of wind preceding an avalanche delivers the most devastating impact, not the snow. And, productive entrepreneurs utilizing fresh technology trigger the power and value of the enterprise, leveraging either an innovative process or technology.

Analyze the "Innovation Value Grid" on page 91. Recall that all five of the previously mentioned fastest-growing firms are evidence of process innovations. On this grid, both Amazon and e-Harmony leverage technology, but principally change a process, thereby improving a customer experience to create value. When we step up to an ATM machine, stop at a KFC drive-through, or jump on a discount airline flight, our lives are improved, time is saved, and value is realized. The direct commercialization of new science or technologies like non-invasive neurosurgery, anti-viral nano-coated stents, or voice-over Internet connections via Wi-Fi may be catalyzing innovations. And, in such precise, clear-cut cases, entrepreneurial success more directly ties to the technology.

THE INNOVATION VALUE GRID

	Innovation as Catalyst for Business	Product/Service as Consequence of Innovation
New Technology	Genentech (DNA splice to drugs)	Facebook (community)
Improved Process	Amazon (Internet connection to books)	e-Harmony (social interactions)

Question Three: Does hyper-velocity growth on a broad, sustainable scale stand on the shoulders of new technology, or in its shoes?

No bright line separates innovation as a consequence versus a cause, because it is a continuum—nor is advancing technology versus improving process a clean distinction, especially when factoring in product life cycles. Yet, whether it is innovative improvements at the local dry cleaner or original software on a mobile phone, innovation comes in many guises, far from the least being process innovation (which is a fancy way of saying, "Here's how to do this better.").

And, this is a distinction with a difference: In aggregate, the fastest-growing companies are on the "improved process" line, with most of them in the "product/service as consequence" quadrants.

The ultimately unsurprising realization is the "back to the future" element of the analysis, which means it should be anticipated. Marketing skills and individuals' ability to recognize and capitalize on opportunity are the great wealth creators and the triggers for sustainable value creation. A science of entrepreneurship

is evolving, but its ability to detect and direct success will increasingly center on fine-tuning the entrepreneur, not the technology—just like the best athletic equipment and training can be applied to all athletes but can never substitute for singular ability. The lab remains a critical component in advancing science and well-being, but the center of wealth creation is the entrepreneur and the non-oxymoron of "old-fashioned process change." In the end, iterative change, and not the one "big idea," creates lasting value.

Final Question: Does this leave us with an uneasy sense that entrepreneurs are born and not taught, or that MBAs are the least likely candidates for high-growth proprietorships?

I think not. The art will be to grow and then graft the new science of entrepreneurship to high-potential candidates, creating an environment that sponsors innovation in process, as well as technology, and recognizes the cause and effect roles of innovation in wealth creation.

Okay, all pencils down, and Blue Books turned in at the front of the room!